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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/683,937	10/10/2003	Yihwan Kim	APPM/8538/TSG/EPI/RKK	2191
44257	7590	11/30/2005	EXAMINER	
PATTERSON & SHERIDAN, LLP 3040 POST OAK BOULEVARD, SUITE 1500 HOUSTON, TX 77056			TRINH, MICHAEL MANH	
			ART UNIT	PAPER NUMBER
			2822	

DATE MAILED: 11/30/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/683,937	Applicant(s) KIM ET AL. 	
	Examiner Michael Trinh	Art Unit 2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 September 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-27, 42, and reinstated 43-55 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-27 and 42-55 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>6-17-05</u> | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

*** This office action is in response to Applicant's Amendment filed September 19, 2005.

Claims 1-27,42 are pending. Claims 43-55 were canceled, and "previously presented".

*** The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Election/Restrictions

*** Restriction to claims 43-55 are hereby withdrawn, as claim 43 is broad and generic to amended claim 1. Since claims 43-55 were canceled by Applicant in the amendment filed September 19, 2005, Applicant can reinstate claims 43-55 in response to this office action for rejoinder. In advance, if claims 43-55 are reinstated, claims 43-55 are also rejected by prior art in this office action. Claims 43-55 were canceled, but reinstated and treated as "previously presented". In view of the withdrawal of the restriction requirement, applicant(s) are advised that if any claim(s) presented in a continuation or divisional application include all the limitations of a claim that is allowable in the present application, such claims may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application. Once the restriction requirement is withdrawn, the provisions of 35 U.S.C. 121 are no longer applicable. See *In re Ziegler*, 44 F.2d 1211, 1215, 170 USPQ 129, 131-32 (CCPA 1971). See also MPEP § 804.01.

Claim Rejections - 35 USC § 112

1. Claim 42 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "greater than about" in claim 42 is a relative term which renders the claim indefinite. The term "greater than about" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention, where there was close prior art and there was nothing in the specification as to define what range of specific activity (MPEP 2173.05(b) A.

Claim Rejections - 35 USC § 102

2. Claim 42, insofar as understood, is rejected under 35 U.S.C. 102(b) as being anticipated by Oda et al (2001/0045604).

Oda teaches a method of depositing a silicon germanium film on a substrate comprising: providing the substrate within a process chamber; heating the substrate to a temperature in a range from about 500 to about 900 degree C (paragraph 100, lines 25-50); exposing the substrate to a deposition gas comprising a silicon-containing gas, a germanium source, a hydrogen chloride and a boron-containing dopant gas (paragraph 100, lines 7-25; B₂H₆ in paragraph 0100), wherein the silicon germanium material is deposited with a boron concentration in a range from about 1×10^{20} atoms/cm³ (paragraph 0103; paragraphs 0136 and 0153), wherein Oda also disclosed “the upper limit may be 1×10^{20} cm⁻³ at which the diffusion of the dopant is remarkable”. In other words, Oda already recognized and thus disclosed that diffusion of the dopant is remarkable by having the dopant concentration greater than about 1×10^{20} cm⁻³.

Claim Rejections - 35 USC § 103

3. Claims 1-11,12-24,25-27,42,43-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oda et al (2001/0045604) taken with Steele et al (5,273,930) and Murthy et al (6,235,568).

Oda teaches a method of depositing a silicon germanium film on a substrate comprising: providing the substrate within a process chamber; heating the substrate to a temperature in a range from about 500 to about 900 degree C (paragraph 100, lines 25-50) ; exposing the substrate to a first deposition gas comprising SiH₄, GeH₄, HCl, a carrier gas of hydrogen and at least one dopant gas (paragraph 100, lines 7-25); and depositing a first silicon germanium material epitaxially on the substrate, wherein the silicon germanium material is deposited with a boron concentration in a range from about 1×10^{20} atoms/cm³ (paragraph 0103; paragraphs 0136 and 0153), wherein Oda also disclosed “the upper limit may be 1×10^{20} cm⁻³ at which the diffusion of the dopant is remarkable”; in other words, Oda already recognized and thus disclosed that diffusion of the dopant is remarkable by having the dopant concentration greater than about 1×10^{20} cm⁻³; and exposing the substrate to a second deposition gas, wherein the gas comprises dichlorosilane (lines 5-25 of paragraph 100) and a germanium source to deposit a

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second silicon germanium material on the first material (Figs 13,10,11,5-6; paragraphs 0123,0116,0103). Re claim 2,45,47,48,51,52, wherein the at least one dopant gas is a boron containing compound selected from the group consisting of diborane (B_2H_6 in paragraph 0100). Re claim 3,46, wherein the silicon germanium material is deposited with a boron concentration in a range from about 1×10^{20} atoms/cm³ (paragraph 0103; and paragraphs 0136 and 0153), wherein Oda disclosed “the upper limit may be 1×10^{20} cm⁻³ at which the diffusion of the dopant is remarkable”. Re claim 4,45,51, wherein the at least one dopant gas includes a phosphorus containing compound of phosphine (PH_3 I paragraph 0100). Re claim 5, wherein the carrier gas is hydrogen (paragraph 0100, lines 25-25). Re claim 6, wherein the deposition gas further comprises a member selected from the group of consisting of a carbon source, Cl_2SiH_2 (paragraph 0100, lines 7-45). Re claim 7, wherein the temperature is of 600° C or higher to about 900°C, wherein a temperature of 750°C is used, wherein the process chamber is at a pressure of 0.1 Pa (paragraph 0101; page 7, right column, lines 3-11, wherein 0.1 Pa is in the claimed range from about 0.1 Torr to about 200 torr). Re claims 8,54, wherein the silicon germanium film is grown to a thickness in a range from about 1nm to 50nm (paragraph 0103, page 7, right column). Re claim 9, wherein the silicon germanium film is deposited within a device used for CMOS, Bipolar or BiCMOS application (paragraphs 0003, 0010). Re claim 10, wherein a fabrication step is selected from the group consisting of contact plug, source/drain extension, elevated source/drain 13,14,134,135 and bipolar transistor with buffer layer 8 (Fig 3D; paragraphs 0089-0110,0103). Re claim 12, wherein a silicon-containing film 104 is deposited to the substrate before the silicon germanium film 105 (Fig 45; paragraph 0006; Fig 46; paragraph 0009; Figs 3e-3d; 4-6; paragraphs 0101-0104). Re claim 13, wherein the silicon-containing film is deposited from a process gas comprising Cl_2SiH_2 (paragraphs 0100,0103). Re claim 14, as already similarly applied in claims 1 and 3, with a dopant concentration of about 1×10^{20} atoms/cm³ (paragraph 0103). Re claim 15, wherein the germanium source is selected from the group consisting of GeH_4 (paragraph 0100). Re claim 16, wherein the carrier gas is hydrogen (paragraph 0100, lines 25-25). Re claims 17,55, wherein the temperature is of 600° C or higher to about 900°C, wherein a temperature of 750°C is used. Re claim 18, wherein the etchant source is selected from the group consisting of HCl, and Cl_2 (paragraph 0100). Re claim 19, wherein the at least one dopant gas is a boron containing compound selected from the group

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consisting of diborane (B_2H_6 in paragraph 0100). Re claim 20, wherein the at least one dopant gas includes a phosphorus containing compound of phosphine (PH_3 I paragraph 0100). Re claim 21, wherein the deposition gas further comprises a member selected from the group of consisting of a carbon source, Cl_2SiH_2 (paragraph 0100, lines 7-45). Re claim 22, wherein the silicon germanium film is grown to a thickness in a range from about 1nm to 50nm (paragraph 0103, page 7, right column). Re claim 23, wherein the silicon germanium film is deposited within a device used for CMOS, Bipolar or BiCMOS application (paragraphs 0003, 0010). Re claim 24, wherein a fabrication step is selected from the group consisting of contact plug, source/drain extension, elevated source/drain 13,14,134,135 and bipolar transistor with buffer layer 8 (Fig 3D; paragraphs 0089-0110,0103). Re claim 26, wherein a silicon-containing film 104 is deposited to the substrate before the silicon germanium film 105 (Fig 45; paragraph 0006; Fig 46; paragraph 0009; Figs 3e-3d; 4-6; paragraphs 0101-0104). Re claim 27, wherein the silicon-containing film is deposited from a process gas comprising Cl_2SiH_2 (paragraphs 0100,0103).

Oda teaches a concentration of 1×10^{20} atoms/cm³ or less; while claim 1 recites greater than 1×10^{20} atoms/cm³ (claim 14 recites about 2×10^{20} atoms/cm³; claim 42 recites greater than about 1×10^{20} atoms/cm³). Re further claim 25,1, Oda also lack replacing SiH_4 by Cl_2SiH_2 to deposit a second silicon germanium film.

However, Oda already teaches to (at lines 5-10) using either silane (SiH_4) or dichlorosilane (Cl_2SiH_2) as a silicon source gas for depositing the silicon germanium material on the substrate. Steele teaches (at col 3, line 50 through col 4; cols 5-6) depositing a seed film to a first thickness, then replacing silane (SiH_4) by dichlorosilane (Cl_2SiH_2) to deposit a second silicon germanium film to a second thickness on the seed film. Murthy teaches using a silicon source gas, a germanium source gas, a hydrochloride, and boron dopant source gas (col 7, line 45 through col 8, line 67) to deposit a doped silicon germanium material having a dopant concentration of greater than about 5×10^{20} atoms/cm³ (col 3, lines 42-47; col 5, lines 30-40; col 11, lines 8-15).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form silicon germanium materials of Oda by using silicon source gases of silane (SiH_4) and dichlorosilane (Cl_2SiH_2) to deposit a second silicon germanium film to a second thickness on the seed film as taught by Oda and Steele, wherein replacing silane (SiH_4)

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by dichlorosilane (Cl_2SiH_2) as taught by Steele. This is because of the desirability to improve performance of the product films, and to form a silicon germanium film having lower bandgap energy. The subject matter as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made to select the portion of the prior art's range of dopant concentration, as taught by Murthy, which is within the range of applicant's claims, because it has been held to be obvious to select a value in a known range by optimization for the best results, and would be an unpatentable modification, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation". *In Re Aller* 104 USPQ 233,255 (CCPA 1955); *In re Waite* 77 USPQ 586 (CCPA 1948); *In Re Swanson* 56 USPQ 372 (CCPA 1942); *In Re Sola* 25 USPQ 433 (CCPA 1935); and *In Re Dreyfus* 24 USPQ 52 (CCPA 1934).

Response to Amendment

4. Applicant's arguments filed September 19, 2005 have been fully considered but they are moot in view of new ground(s) of rejection.

** Applicant remarked that "Steele teaches away from selectively depositing...".

In response, this is noted and found unconvincing. Oda, as a main reference, clearly teaches selectively depositing a silicon germanium material on the substrate.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

*** Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael M. Trinh whose telephone number is (571) 272- 1847. The examiner can normally be reached on M-F: 8:30 Am to 5:00 Pm.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number is (571) 273-8300

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.
Oacs-16

A handwritten signature in black ink, appearing to read "Michael Trinh".

Michael Trinh
Primary Examiner